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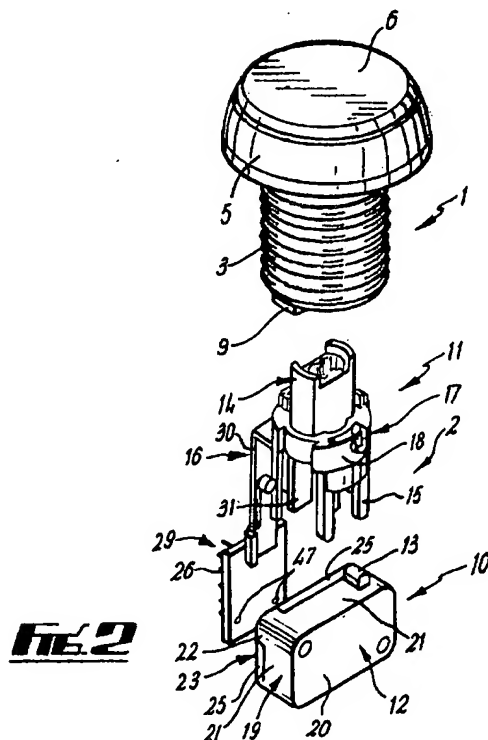
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(54) **Switch assemblies**

(57) An illuminated push-button switch has a micro-switch (10) and a lampholder (11) mounted at an inner end of a tubular body (1). A push-button (6) at an outer end of the body (1) moves an inner slider (7) on to an operating member (13) of the microswitch (10). A print-

ed circuit board (26) is mounted on one side of the microswitch (10). Terminals (43, 44, 33) of the microswitch (10) and terminals (27, 28) of the lampholder (11) are connected to the printed circuit board (26) and the board (26) has transversely projecting prongs (29) which can be engaged with a terminal connector.



Description

[0001] This invention relates to illuminated push button electrical switch assemblies.

[0002] A known illuminated push button electrical switch assembly, as commonly used in amusement and gaming machines, has a base structure with a microswitch and a lamp/LED holder, and a tubular body part which fits around the lamp holder at one end and has a push button at the opposite end. Within the body part there is a slider element which is moved by the push button to operate the micro-switch.

[0003] A switch assembly of this kind is described in GB 2288278-B, and also in copending application GB 9922382.8.

[0004] With this known kind of electrical switch assembly the preferred microswitch is a proprietary component which has switching elements within a generally rectangular housing. These elements are operated by application of pressure to an operating member which projects through a top long edge of the housing adjacent to one end of such edge. Two or three connection terminals in the form of bent metal strips also project through the housing. The lamp holder is fitted on the top long edge of the housing adjacent the projecting operating member with mounting leg structures of the holder straddling opposite side faces of the housing. Connection terminals of the lamp holder, also in the form of bent metal strips, project outwardly on opposite sides.

[0005] With this arrangement, the two or three microswitch terminals, and the two lamp holder terminals may be directed in different directions and may require separate connectors which can take up a considerable amount of space, especially since switching diodes are commonly incorporated in two of the terminal connectors. This is disadvantageous in so far as it is usually required to mount the switch assembly in close proximity to other switch assemblies or other components or structures within a confined space.

[0006] With a view to reducing space requirements it has been proposed to use a smaller microswitch mounted on a printed circuit board (PCB) whereby the usual diodes can be mounted on the PCB and a compact terminal arrangement can be provided for connection purposes. However, small PCB microswitches tend not to have the same positive action feel as the larger stand alone switches whereby they may not be as appealing to the user.

[0007] It has also been proposed to use smaller purpose-made stand alone microswitches. With these, space requirements can be improved, and the 'feel' can be made acceptable, but the non-standard nature of the switch and particularly its terminals has been found to give rise to problems with regard to the convenient attachment of connectors.

[0008] An object of the present invention is to provide a microswitch arrangement which can combine compact space requirements with good operational 'feel'

and convenient terminal connections.

[0009] According to the invention therefore there is provided an illuminated push button electrical switch assembly comprising a base structure having a microswitch and a lamp holder, and a tubular body part adapted to fit around the lamp holder at an inner end region and having a push button at its opposite outer end region, wherein the microswitch is of the kind having a housing with an operating member and also terminals projecting therethrough, characterised in that the microswitch is mounted relative to a circuit board, the board is provided with board terminals for connection to a cooperable terminal connector, and the switch terminals are connected to the board terminals.

[0010] With this arrangement the microswitch can be of the kind having a positive action feel whilst at the same time compact space requirements and convenient terminal connections can be achieved.

[0011] Most preferably the microswitch housing is generally rectangular and the operating member may project through a top long edge of the housing adjacent to one end thereof.

[0012] More particularly, the microswitch housing may be formed from two generally rectangular shells each having a side face bounded by peripheral edge walls, and the shells being fixed together with their respective edge walls in contact with each other to enclose a space therebetween in which switch operating elements are enclosed, said elements being interoperable against the action of a spring by application of pressure to the operating member, and the said switch terminals being connected to said operating elements.

[0013] The microswitch may be mounted relative to the circuit board by means of the said switch terminals which may be soldered or otherwise electrically and mechanically connected to the board.

[0014] Alternatively, the microswitch may be mounted relative to the circuit board by attachment of the board relative to the microswitch housing, the switch terminals being connected via connection points on the board.

[0015] In a particularly preferred embodiment, the circuit board is bonded or otherwise attached to or substituted for, or forms part of, a side wall of the housing. In the case of a generally rectangular housing the circuit board may be applied to one side face thereof.

[0016] With regard to the board terminals these preferably comprise a row of side by side parallel prongs for interengagement with a socket-type terminal connector, particularly a standard AMP connector. The prongs may extend transversely, particularly perpendicularly from the board. Where the board is applied to a side face of the housing the prongs preferably project transversely to such side face.

[0017] In addition to the switch terminals, terminals of the lamp holder may also be connected via connection points on the board to the board terminals.

[0018] The board may also have thereon one or more associated components such as diodes interposed be-

tween board terminals and one or more of the other terminals.

[0019] Most preferably the board is a printed circuit board (PCB).

[0020] With regard to the lamp holder and the tubular body part of the switch assembly these may be as described in GB 2288278-B and/or GB 9922382.8, as appropriate.

[0021] Thus, the tubular body part may contain an internal slider element adapted to be moved by the push button into the operative interengagement with the operating member of the microswitch, the base structure and the inner end region of the body part having interfitting elements to effect detachable interconnection of the body part and the base structure. The interfitting elements may comprise at least one transverse projection engageable with a respective aperture, provided on respective ones of the base structure and the body part, the projection being a close fit in the aperture circumferentially of the tubular body part, and at least one of the projection and the inner end region of the body part being transversely resiliently deflectable.

[0022] With regard to the lamp holder, this may have opposed leg structures which straddle opposite side faces of the housing, the housing being held captive, preferably removably between such leg structures.

[0023] In the case of the generally rectangular housing described above, the lamp holder may straddle the housing at the top long edge thereof, particularly at a position adjacent to the projecting operating member.

[0024] The leg structures of the lamp holder may take any suitable form. In a particularly preferred embodiment, where the board terminals project transversely to one side face of the housing as mentioned above, the leg structure at such side may be of the form of a channel to fit around the board and may be slotted to allow passage therethrough of the board terminals.

[0025] The switch assembly of the invention is particularly suited for use in an amusement or gaming machine but may be used in any other suitable context.

[0026] The invention will now be described further by way of example only and with reference to the accompanying drawings in which:-

- Figure 1 is a perspective view of one form of a press-button assembly according to the invention;
 Figure 2 is an exploded perspective view of the assembly of Figure 1;
 Figure 3 is a side view of the assembly of Figure 1;
 Figures 4 & 5 are sections on the line IV-IV and V-V of Figure 3;
 Figure 6 is an enlarged plan view of the microswitch of the assembly of Figure 1 with a side cover removed;
 Figure 7 is a perspective view of the switch of Figure 6 with the side cover in posi-

tion; and

Figure 8 is a perspective view of a modification of the embodiment of Figures 1-7.

[0027] Referring to Figures 1-5, the switch assembly shown in the drawings is for use for player operation in an amusement or gaming machine, such as a fruit machine, or poker machine, or other slot machine.

[0028] The switch assembly is mounted in a mounting hole of a panel of the machine.

[0029] The assembly has a body part 1 and a base structure 2.

[0030] The body part 1 comprises a one-piece plastics moulding which has a cylindrical section 3 with an external thread along its length and an integral radially outwardly extending flat circular rim 4 at the outer end of the body part.

[0031] A circular collar 5 is attached around this rim (or may be formed integrally therewith) and a transparent or translucent push button 6 of hollow disc-shaped form fits slidably within the head defined by the rim 4 and the collar 5. The push button 6 is provided with decoration and/or information visible at its outer surface.

[0032] The push button 6 is formed integrally with the outer end of a slider element 7 within the cylindrical section 3. This slider element 7 comprises a moulded plastics cylindrical tube 8 with two axially projecting narrow strip-shaped feet 9 at diametrically opposed positions at its inner end. The feet 9 have radially outwardly turned ends.

[0033] This tube 8 is located coaxially within the cylindrical section 3 of the body part 1 and is of smaller diameter so that it can slide freely along the cylindrical section 3.

[0034] A helical coil spring (not shown) urges the push button 6 and the slider element 7 outwardly, limited by the engagement of the ends of the feet 9 with the inner end of the cylindrical section 3 of the body part 1.

[0035] The base structure 2 comprises two separately, attached components, namely a microswitch 10 and a lamp holder 11.

[0036] The microswitch 10 has a rectangular body 12 with an upper projecting operating member 13, as described in more detail below.

[0037] The lamp holder 11 comprises a one-piece plastics moulding which has a lamp receiving part 14, integral lower leg structures 15, 16 which straddle and hold captive the body 12 of the switch 10, and a central collar 17 which is cut away to define two arms 18 which extend circumferentially in opposite directions at diametrically opposed positions.

[0038] These arms 18 are configured to interlock detachably with corresponding structures at the inner ends of the body 1 as described in copending application GB 99.22382.8 to which reference is made for further details.

[0039] In use, the cylindrical section 4 of the body part

1 is pushed through and retained within a hole in the panel of the machine in which the switch assembly is to be mounted.

[0040] A lamp is inserted into the lamp holder 11 and the lamp and the lamp holder 11 are pushed into and retained within the inner end of the cylindrical section 3.

[0041] The arrangement is such that the out-turned end of one of the feet 9 is closely over the operating member 13 of the microswitch 10. The push button 6 can now be pushed to cause the slider element 7 to move within the cylindrical section 3 against the action of its spring to cause the switch operating member 13 to be depressed. On release, the push button 6 is moved back by the spring.

[0042] As best shown in Figures 6 and 7, the microswitch 10, as mentioned, has a generally rectangular body 12 and this is made from two rigid plastics mouldings: a first relatively deep hollow rectangular shell 19 having a flat rectangular side wall 20 bounded by peripheral common height edge walls 21 and two axially bored corner posts 22 upstanding beyond the edge walls 21 at two diagonally opposed corners; and a second relatively shallow hollow rectangular shell 23 having a flat rectangular side wall 24 bounded by peripheral common height edge walls 25, this side wall 24 being of the same rectangular size and shape as the other side wall 20 except for two diagonally opposed part circular cut outs to accommodate the corner posts 22. These cut outs are optional.

[0043] The two mouldings 19, 23 are fixed together with the edge walls 21, 25 in contact with each other and the corner posts 22 fitting within the cut outs so as to enclose a space between the side walls 20, 24.

[0044] Within this space there are located usual electrical operating components of the microswitch namely a shaped, multi-part springy conductive strip 40 which can be pressed by the operating member 13 against the action of its own resilience, and/or against the action of a coil spring, to bring a contact 41 on the strip 40 into engagement with a fixed electrical contact 42. The operating member 13 is a short plastics rod which projects outwardly of the housing 12 through a bore in the upper peripheral edge wall 21 adjacent to one end of such wall, such rod being retained against displacement completely through the bore by means of an enlarged head at its inner end.

[0045] The microswitch 10 so far described is of known construction. With the known switch there are two terminals 43, 44 in the form of rigid bent copper or brass strips which project through slots in peripheral edge walls 21 of the deep moulding 19, inner ends of these strips connecting respectively with the spring loaded strip 40 and the aforesaid contact 42. There may also be a third such strip which has an inner end connecting with a second contact engaged by the strip when pressure on the operating member 13 is released.

[0046] In accordance with the present embodiment of the invention, these terminal strips 43, 44 are removed,

or cut off level with the outer periphery of the housing 12 (as shown in broken lines in Figure 6) and in their place there are conductive extensions 45, 46 connected to the internal residual stumps of the terminals 43, 44 and which extend through the side wall 24 of the shallow housing shell 23.

[0047] To the outer surface of this shell there is fixed a small rectangular printed circuit board 26. There are printed conductors on the face of this board remote from the shell 23. The aforesaid extensions 45, 46 extending through the shell 23 connect with conductors at points on the printed circuit board e.g. by solder connections e.g. at 47 shown in Figure 2. In addition the two terminals 27, 28 of the bulb holder connect with conductors at points on the printed circuit board e.g. by pressure contact.

[0048] A standard terminal connector 'plug' 29 is mounted on the board, this having a row of parallel like prongs which project perpendicularly from the PCB 26 for engagement with a standard AMP (or similar) female terminal socket connector at the end of a multi-conductor lead.

[0049] There are also two diodes on the PCB 26 and the microswitch terminals and the two lamp holder terminals are linked to the connector plug 29, two of these via the two diodes.

[0050] As can be seen from the drawings the lamp holder 11 has on one side of the switch 10 an open leg structure 15 defined by two spaced apart prongs. On the other side of the switch the lamp holder has a leg structure 16 having a channel 30 with out-turned flanges along opposite sides, and a central slot 31 bounded along one edge by an upstanding projection 32.

[0051] The switch 10 is straddled by the leg structures 15, 16 such that the PCB 26 fits closely between the sides of the channel 30 and the prongs of the connector plug 29 project through the slot 31 alongside the projection 32. The slot 31 is open ended as shown so that the leg structure 16 can slide into position over the prongs. If desired, for strength, the open end of the slot 31 may have a bridge-piece which is large enough to clear the prongs.

[0052] The prongs and the projection 32 interfit with the interengageable socket connector in conventional manner.

[0053] With this arrangement a proprietary microswitch mechanism which is robust and long lasting and which has a good positive action feel can be used, yet the switch arrangement is compact and convenient to install in so far as all connections are made via the relatively unobtrusive PCB 26 and the standardised connector plug 29.

[0054] Figure 8 shows a modified version of the arrangement of Figures 1-7 and the same reference numerals are used for corresponding components. A conventional microswitch is used, as discussed above, but this is connected to the PCB 26 by external modification (bending) of its terminals 33 to extend and terminate ad-

jacent to the outer face 24 of one of the housing shells 23. The PCB 26 may be secured to this face or may be secured solely by the attachment of the terminals 33.

[0055] The PCB 26 has thereon the diodes and connector plug 29, and is straddled by the lamp holder leg structures 15, 16 as described above, although the structure 16 may be shaped to fit between the PCB 26 and the housing 12 rather than outside the PCB 26.

[0056] This modified arrangement has many of the advantages of the arrangement of Figures 1-5, although it may be somewhat less compact.

[0057] It is of course to be understood that the invention is not intended to be restricted to the details of the above embodiments which are described by way of example only.

Claims

1. An illuminated push-button electrical switch assembly comprising a base structure (2) having a microswitch (10) and a lamp holder (11), and a tubular body part (1) adapted to fit around the lamp holder (11) at an inner end region and having a push button (6) at its opposite outer end region, wherein the microswitch (10) is of the kind having a housing (12) with an operating member (13) and also terminals (43, 44 or 33) projecting therethrough, **characterised in that** the microswitch (10) is mounted relative to a circuit board (26), the board (26) is provided with board terminals (29) for connection to a co-operable terminal connector, and the switch terminals (43, 44 or 33) are connected to the board terminals (29).
2. An assembly according to claim 1 **characterised in that** the microswitch housing (12) is generally rectangular and the operating member (13) projects through a top long edge of the housing adjacent to one end thereof.
3. An assembly according to claim 2 **characterised in that** the microswitch housing (12) is formed from two generally rectangular shells (19, 23) each having a side face (20, 24) bounded by peripheral edge walls (21, 25), and the shells being fixed together with their respective edge walls in contact with each other to enclose a space therebetween in which switch operating elements (40-42) are enclosed, said elements being interoperable against the action of a spring by application of pressure to the operating member (13), and the said switch terminals (43, 44) being connected to said operating elements (40-42).
4. An assembly according to claim 3 **characterised in that** the switch terminals (43, 44) have extensions (44, 45) connected thereto which project through

one of the side faces (20, 24) of the shells (19, 23) for connection of the switch terminals (43, 44) to the board terminals (29).

5. An assembly according to claim 4 **characterised in that** the terminals (43, 44) comprise conductive strips which extend internally of the housing (12) through edge walls (21, 25) thereof and are cut off at such walls.
6. An assembly according to claim 3 **characterised in that** the terminals (33) comprise conductive strips which extend internally of the housing (12) through edge walls (21, 25) thereof and are bent to project transversely externally of the housing (12).
7. An assembly according to any one of claims 1 to 6 **characterised in that** the microswitch (10) is mounted relative to the circuit board (26) by means of the said switch terminals (43, 44 or 33).
8. An assembly according to any one of claims 1 to 6 **characterised in that** the microswitch (10) is mounted relative to the circuit board by attachment of the board (26) relative to the microswitch housing (12), the switch terminals (43, 44) being connected via connection points (47) on the board (26).
9. An assembly according to claim 8 **characterised in that** the board terminals (29) comprise a row of side by side parallel prongs for interengagement with a socket-type terminal connector.
10. An assembly according to claim 9 **characterised in that** the prongs extend transversely to the board.
11. An assembly according to claim 10 **characterised in that** the board (26) is applied to a side face (23) of the housing (12) and the prongs project transversely to such side face.
12. An assembly according to any one of claims 1 to 11 **characterised in that** terminals (27, 28) of the lamp holder (11) are connected via connection points on the board to the board terminals.
13. An assembly according to any one of claims 1 to 12 **characterised in that** the board (26) also has thereon one or more diodes interposed between board terminals and one or more of the other terminals.
14. An assembly according to any one of claims 1 to 13 **characterised in that** the board (26) is a printed circuit board.
15. An assembly according to any one of claims 1 to 14 **characterised in that** the tubular body part (1) contains an internal slider element (7) adapted to be

moved by the push button (6) into the operative interengagement with the operating member (13) of the microswitch (10), the base structure (2) and the inner end region of the body part (1) having interfitting elements to effect detachable interconnection of the body part and the base structure. 5

16. An assembly according to claim 15 **characterised in that** the interfitting elements comprise at least one transverse projection engageable with a respective aperture, provided on respective ones of the base structure (2) and the body part (1), the projection being a close fit in the aperture circumferentially of the tubular body part, and at least one of the projection and the inner end region of the body part being transversely resiliently deflectable. 10 15
17. An assembly according to any one of claims 1 to 16 **characterised in that** the lamp holder (11) has opposed leg structures (15, 16) which straddle opposite side faces of the housing (12). 20
18. An assembly according to claim 17 when dependent on claim 2 **characterised in that** the lamp holder (11) straddles the top long edge of the housing (12). 25
19. An assembly according to claim 17 or 18 when dependent on claim 8 **characterised in that** the leg structures (15, 16) at the said side are of the form of a channel (30) to fit around the board (26). 30
20. An assembly according to claim 19 **characterised in that** the leg structures (15, 16) are slotted to allow passage therethrough of the board terminals. 35

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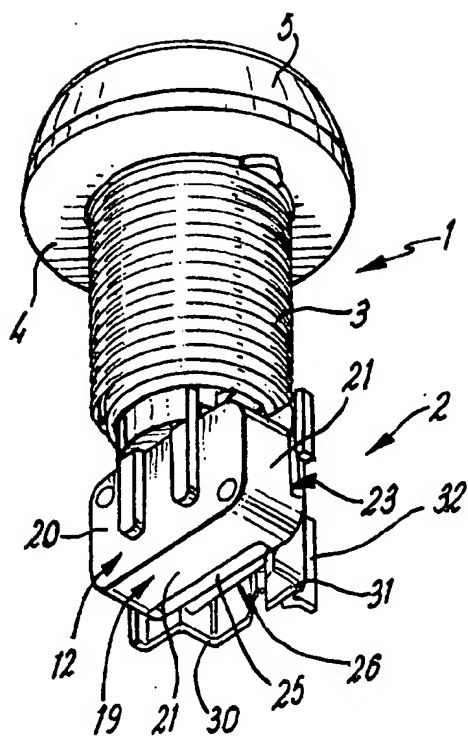


FIG. 1

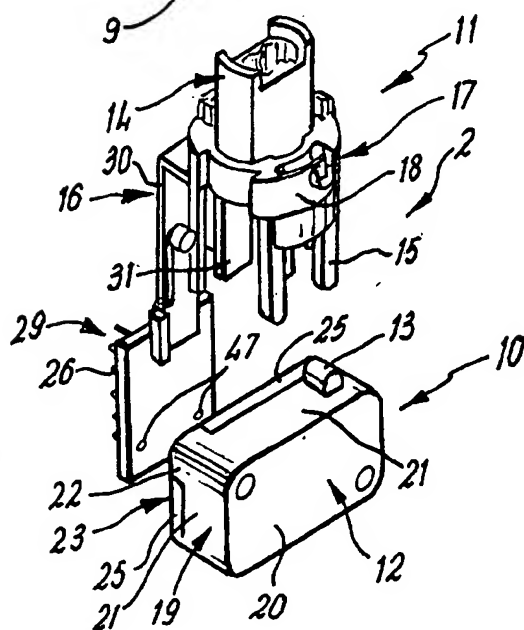
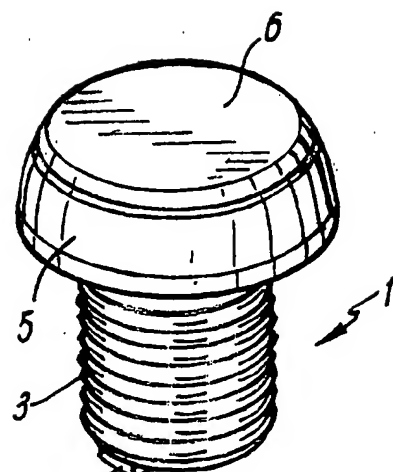


FIG. 2

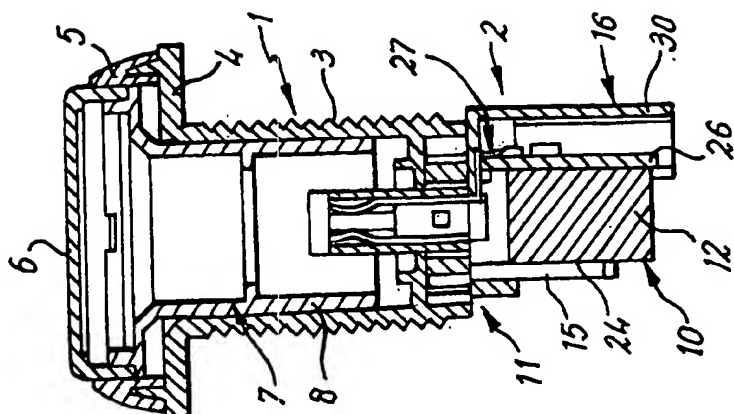


Fig. 5

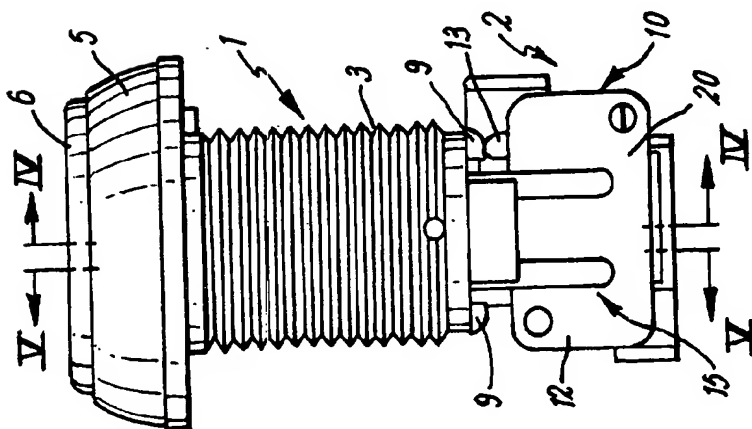


Fig. 3

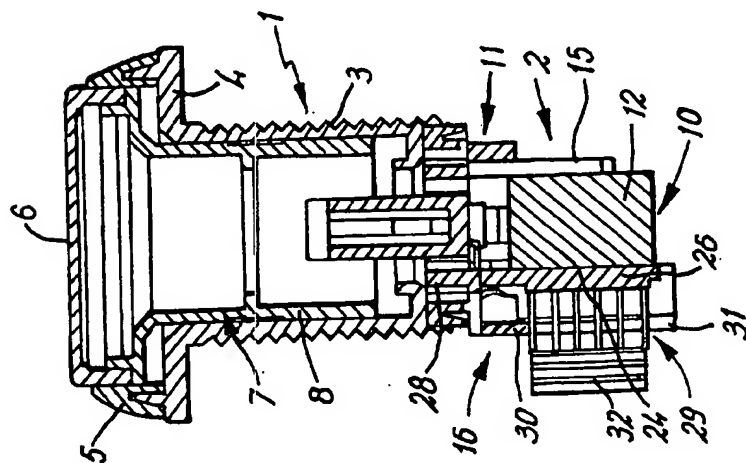


Fig. 4